# MORISON

# SUSPENSION FURNACES

MANUFACTURED BY

## THE CONTINENTAL IRON WORKS

BROOKLYN, N. Y.

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# MORISON SUSPENSION FURNACES

# MARINE AND LAND BOILERS.

FOR

SOLE MANUFACTURERS IN THE

## UNITED STATES,

## The Continental Iron Works

(GREENPOINT)

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# MORISON SUSPENSION FURNACES.

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THE CONTINENTAL IRON WORKS,

BROOKLYN, N. Y.

# The Morison Suspension Furnace.

THIS type of furnace (designed and patented by Mr. Donald B. Morison, of Hartlepool, England) is the result of a series of exhaustive experiments, which were conducted at Leeds, England, under the auspices of Mr. Samson Fox, the introducer and promoter of the world renowned "Fox Corrugated Furnace." So indispensable has the Fox Furnace become that more of them are in daily use, than the aggregate of all other types of horizontal cylindrical furnaces. It has commanded respectful consideration, and been without a rival until the advent of "The Morison Suspension Furnace," and this, notwithstanding the fact, that during the last decade numerous attempts have been made to produce some type of boiler furnace, which would vie with, and share in the reputation of "The Fox Corrugated Furnace."

"The Morison Suspension Furnace," inherits all the well-known and valuable features of "The Fox Corrugated Furnace," but in a more pronounced and perfect development. The catenary form of curve, the distance between centers of ridge arch supporters, and the general proportions as adopted, have been experimentally determined and practically proven to offer the greatest resistance to distortion or collapse, and to present a crown surface offering the minimum facility for lodgment of scale, together with a maximum convenience for readily removing the same when formed. These marked advantages have been speedily recognized by owners and users of steam boilers, and the invention has met with the fullest appreciation of, and been properly classified by the English Admiralty, Lloyds, Bureau Veritas and the Board of U. S. Supervising Inspectors.

The freedom from liability to crack and distort, so incident to cylindrical furnaces which are reinforced with incorporated thick ribs, also freedom from the defects incident to that type of furnace composed of sections of flanged and riveted cylinders (ring reinforced) which are liable to change form and develop leakage by reason of undue strains, caused by different degrees of expansion and contraction.—The entire absence of these untoward features in "The Morison Suspension Furnace," has caused its adoption in numbers of Naval and Merchant Steamers of Great Britain, and other European nations, a partial list of names of these vessels being recorded in the pages immediately following.

A particular feature of commercial interest, is the fact that the type of boiler furnace, described as "The Morison Suspension," possessing the same general characteristics as "The Fox Corrugated Furnace," is susceptible of production at the same expenditure, therefore either type, of equal dimensions, and requirements, may be purchased at the same price.

The sole right to the manufacture and sale of "The Morison Suspension Furnace" in Great Britain, is vested with The Leeds Forge Co. of Leeds, England, and in the United States and Canada, with THE CONTINENTAL IRON WORKS OF GREENPOINT, BROOKLYN, N. Y., which corporation invites attention to its products, and solicits the patronage of the engineering profession.

## PARTIAL LIST OF STEAMERS

TO WHICH

# MORISON SUSPENSION FURNACES.

HAVE BEEN FITTED.

| Name of Ship. | Tonnage. | Nominal Horse Power. | OWNERS. |
|---|---|---|---|
| S.S. "Atlantic" | 2478 | 250 | Atlantic Steamship Co. |
| S.S "Zanni Stefanovich" | 2333 | 200 | Foscole Mango and Co. |
| S.S. "Albion" | 3650 | 250 | Rickinson, Son and Co. |
| S.S. "Cuidad de Cadiz" | 3084 | 449 | Compania Transatlantica, Cadiz. |
| S.S. "Pallion" | 1641 | 150 | West Hartlepool Steam Navigation Co. |
| S.S. "Topaze" | 1895 | 180 | Christie and Co. |
| S.S. "Stranton" | 1678 | 150 | West Hartlepool Steam Navigation Co. |
| S.S. "Louch" | .... | ... | Russian Steam Navigation Co. |
| S.S. "9 de Julio" | 3575 | ... | Argentine Republic. |
| S.S. "Afrikander" | 2755 | 500 | British and Colonial Steam Navigation Co. |
| S.S. "Kaffir" | 2736 | 500 | British and Colonial Steam Navigation Co. |
| S.S. "Transvaal" | 2746 | 500 | British and Colonial Steam Navigation Co. |
| S.S. "Zulu" | 2746 | 500 | British and Colonial Steam Navigation Co. |
| S.S. "Teutonia" | 3158 | 220 | Muller and Co. |
| S.S. "Eastry" | 2998 | 260 | Sivewright and Bacon. |
| S.S. "Starlight" | 2956 | 180 | John Wood and Co. |
| S.S. "Glenwood" | 1972 | 180 | Livingston and Conner. |
| S.S. "Tchihatchoff" | 4065 | 385 | Russian Steam Navigation and Trading Co. |
| S.S. "Pyrrhus" | 3572 | 500 | Ocean Steamship Co. |
| S.S. "Pendarves" | 2669 | 250 | J. and R. B. Chellew. |
| S.S. "Birdoswald" | 2993 | 270 | Lunn and Maccoy. |
| S.S. "Straits of Dover" | 2931 | 180 | Neil McLean and Co. |
| S.S. "Powderham" | 3019 | 266 | Bellamy and Co. |
| S.S. "Stolzenfels" | 3030 | ... | Hansa Dampfschiffs, Bremen. |
| S.S. "Horsley Tower" | 3212 | 265 | Stumore and Co. |
| S.S. "Ferrum" | 425 | 55 | G. E. Casebourne and Co. |
| S.S. "Samoa" | 6839 | 600 | Samoa Steamship Co. (Crow Rudolf and Co.) |
| S.S. "Cardinal" | 2303 | 200 | Chadwick Steamship Co. |
| S.S. "Astrakhan" | 3438 | 340 | W. Tapscott and Co. |
| S.S. "Barrister" | 4750 | 500 | T. and J. Harrison. |
| S.S. "Burdon" | 3019 | 270 | West Hartlepool Steam Navigation Co. |
| S.S. "Valhalla" | 1197 | 145 | J. F. Laycock, Esq. |
| H.M.S. "Malabar" | 6211 | 4200 | British Government. |
| S.S "Lobelia" | 2942 | 180 | Captain Lilly. |
| S.S. "Great Northern" | 1422 | 150 | Eastern and South African Telegraph Co. |
| S.S. "Webster" | 3101 | 270 | West Hartlepool Steam Navigation Co. |
| S.S. "Romulus" | 809 | 120 | MacLeod and Co., Manila. |
| S.S. "Ursa" | 2735 | 260 | Herskind and Woods. |
| S.S. "Empress" | 2918 | 250 | Imperial Steamship Co., Limited. |
| S.S. "Arabistan" | 3194 | 304 | Frank G. Strick and Co. |
| S.S. "  " | .... | 600 | Secretary of State for India. |

## Partial List of Steamers to which Morison Suspension Furnaces have been fitted.—*Continued.*

| Name of Ship. | Tonnage. | Nominal Horse Power. | OWNERS. |
|---|---|---|---|
| S.S. "  " | .... | 600 | Secretary of State for India. |
| S.S. "  " | .... | .... | Irrawaddy Flotilla Co., Rangoon. |
| S.S. "Majestic" | 9933 | 2400 | Ismay, Imrie and Co.—White Star Line. |
| S.S. "L. P. Holmblad" | 2137 | 173 | United Steamship Co., Copenhagen. |
| S.S. "C. P. A. Kock" | 1148 | 173 | United Steamship Co., Copenhagen. |
| S.S. "Croft" | 794 | 85 | Royal Niger Co., Chartered and Limited. |
| S.S. "Embiricos" | 2707 | 246 | W. Esplen and Sons. |
| S.S. "Sachem" | 5204 | 593 | George Warren and Co. |
| S.S. "Phœnix" | 2669 | 266 | Hoyland and Co. |
| S.S. "Lucigen" | 3416 | 350 | H. E. Moss and Co. |
| S.S. "Venetia" | 815 | 223 | Lord Ashburton. |
| S.S. "Comète" | .... | .... | French Admiralty. |
| S.S. "Beltisloe" | 2918 | .... | Bennett and Co. |
| S.S. "Coptic" | 4448 | 550 | Ismay, Imrie and Co.—White Star Line. |
| S.S. "Sybil" | 1974 | 200 | R. Gordon and Co. |
| S.S. "Rapahannock" | 3865 | 525 | Chesapeake and Ohio Steamship Co., Limited. |
| S.S. "Shenandoah" | 3865 | 525 | Chesapeake and Ohio Steamship Co., Limited. |
| S.S. "Kanawha" | 3865 | 525 | Chesapeake and Ohio Steamship Co., Limited. |
| No. 1 Hopper Barge | 868 | 160 | Clyde Trust. |
| No. 3 Hopper Barge | 868 | 160 | Clyde Trust. |
| S.S. "Rameses" | 2413 | 300 | Moss Steamship Co., Limited. |
| S.S. "Warrigal" | 4400 | 600 | W. Lund, Esq. |
| S.S. "Cevic" | 8315 | 708 | Ismay, Imrie and Co.—White Star Line. |
| No. 21 Hopper Barge | 874 | 160 | Clyde Navigation Trustees. |
| No. 22 Hopper Barge | 874 | 160 | Clyde Navigation Trustees. |
| S.S. "Olive" | 450 | 80 | J. Burnett and Sons. |
| S.S. "Pelotas" | 2500 | .... | Hamburg Sud Amerikanische Dampfschiffahrts. |
| S.S. "Appomatox" | 3500 | .... | Chesapeake and Ohio Railway Co. |
| S.S. "Zaire" | 3038 | .... | Empreza Nacional de Navegacao à Vapor, Lisbon. |
| S.S. "Kavavola Olga" | 4065 | 385 | Russian Steam Navigation and Trading Co. |
| S.S. "Greenbrier" | 3500 | .. . | Chesapeake and Ohio Railway Co. |
| S.S. "Gascogne" | .... | .... | Compagnie Générale Transatlantique. |
| T.S. "Tego" | 302 | 500 | Brazilian Owners. |
| S.S. "Doric" | 4784 | 550 | Oceanic Steam Navigation Co. |
| S.S. "Benmore" | 3000 | 300 | William Thomson and Co. |
| S.S. "Waterfly" | .... | 25 | ..... |
| S.S. "Teutonic" | 9952 | 2400 | Ismay, Imrie and Co.—White Star Line. |
| S.S. "Cayo Mono" | 2711 | 300 | Bigland and Co. |
| S.S. "Princess May" | 31 | 23 | St. Mawes Steam Tug and Passenger Co. |
| Mud Hopper "Whale" | 180 | 45 | River Weaver Trustees. |
| S.S. "Maroa" | 6802 | 600 | Crow, Rudolph and Co. |
| S.S. "Sweden" | 569 | 80 | West Hartlepool S. N. Co. |
| S.S. "Rothenfels" | 2951 | 266 | Deutsche Dampfschiffs Gesellschaft "Hansa" Bremen. |
| S.S. "Lindenfels" | 2969 | 266 | Deutsche Dampfschiffs Gesellschaft "Hansa" Bremen. |
| S.S. "Caledonia" | 7500 | 1000 | Peninsular and Oriental Steam Navigation Co. |
| S.Y. "Rona" | 1000 | 241 | Thomson and Campbell. |
| S.S. "John Williams" | 663 | 80 | London Missionary Society. |
| S.S. "Terra" | 2726 | 220 | Herskind and Co. |

## Partial List of Steamers to which Morison Suspension Furnaces have been fitted.—*Continued.*

| Name of Ship. | Tonnage. | Nominal Horse Power. | OWNERS. |
|---|---|---|---|
| S.S. "Isla de Mindanao" | 4195 | 546 | Compania Transatlantica, Cadiz. |
| S.S. "Horsa" | 2949 | 255 | Herskind and Co. |
| S.S. "Janeta" | 3350 | 320 | McLay and McIntyre. |
| S.S. "Jeanara" | 3350 | 320 | McLay and McIntyre. |
| S.S. "Borderer" | 2982 | 267 | Borderer Steamship Co. (J. Little and Co.) |
| S.S. "Chiltern" | 1372 | 200 | Eastern Telegraph Co., Limited. |
| S.S. "Vittoria" | 2700 | 250 | Allan C. Gow and Co. |
| S. Dredger "Majestic" | 945 | 180 | S. Pearson and Son. |
| S.S. "Manningtry" | 2900 | .... | Sivewright and Bacon. |
| S.S. "Falls of Bracklinn" | .... | 275 | Wright, Graham and Co. |
| S.S. "Pontic" | 350 | 64 | Oceanic Steamship Co. |
| S.S. "Norman" | 7591 | 1393 | Union Steamship Co. |
| S.S. "Swift" | 630 | 175 | Hutchinson and Son. |
| S.S. "Seaford" | .... | .... | London, Brighton and South Coast Railway Co. |
| S.S. "George Pyman" | 2020 | .... | George Pyman and Co. |
| H.M.S. "Eclipse" | 5500 | 9600 | British Government. |
| H.M.S. "Renown" | 12350 | 10000 | British Government. |
| S.S. "Sirais" | 275 | 104 | Colonel Platt. |
| S.S. "Farsistan" | 4000 | 360 | Frank E. Strick and Co. |
| S.S. "Nurstein" | .... | .... | Deutsche Dampfschiffs Gesellschaft "Hansa" Bremen. |
| S.S. "Florence" | 2128 | 180 | Pyman Brothers. |
| S.S. "Thornycroft" | 1690 | 150 | Murrell and Yeoman. |
| S.S. "Stella" | 2360 | 200 | Herskind and Co. |
| S.S. "Duplex" | .... | .... | Eastern and South African Telegraph Co. |
| S.S. "Aurora" | .... | .... | Rickinson, Son and Co. |
| S.S. "Guelph" | 4832 | 418 | Union Steamship Co. |
| S.S. "Falls of Inversnaid" | 2611 | 200 | Wright, Graham and Co. |
| S.S. "Beeforth" | 2658 | 300 | Newton Appleton and Co. |
| S.S. "Stanley Hall" | 4104 | 400 | R. Alexander and Co. |
| S.S. "Abana" | 4104 | 400 | James M. Wood, Esq. |
| S.S. "Roath" | 2658 | 250 | J. Cory and Sons. |
| S.S. "Madras" | 5650 | 4000 | Peninsular and Oriental Steam Navigation Co. |
| S.S. "Singapore" | 5650 | 4000 | Peninsular and Oriental Steam Navigation Co. |
| S.S. "Berger Carl" | 858 | 160 | Angfartygs Aktiebolaget Sòdra Sverige, in Stockholm. |
| S.S. "Pouschkin" | 1050 | 180 | M. Berne, in Baku. |
| S.S. "Pascha Dadascheff" | 1050 | 180 | Ali Dadascheff, in Baku. |
| S.S. "Tigre" | 3679 | 350 | Cie des Messageries Maritimes. |
| S.S. "Entre-Rios" | .... | .... | Chargeurs Reunis. |
| S.S. "Sultan" | .... | .... | Ocean Steamship Co. |
| S.S. "Planet Mercury" | .... | .... | F. Leylands and Co. |
| S.S. "Bencliff" | .... | .... | Geo. Horsley and Son. |
| S.S. "Barin Glamis" | .... | .... | Hugh Hogarth. |
| S.Y. "Zoraide" | 520 | 125 | T. J. Waller. |
| S.S. "Mount Sirion" | .... | .... | Smith and Service. |
| S.S. "John Cockerill" | 3500 | .... | Societe John Cockerill. |
| S.S. "Logician" | .... | .... | T. and J. Harrison. |
| S.S. "Valentia" | .... | 93 | Goodyear and Co. |
| S.S. "Marristow" | 2268 | .... | Bellamy and Co. |

## Partial List of Steamers to which Morison Suspension Furnaces have been fitted.—*Continued.*

| Name of Ship. | Tonnage. | Nominal Horse Power. | OWNERS. |
|---|---|---|---|
| S.S. "Leyden" | 3360 | .... | Mess. Alexander. |
| S.S. "Ching Wo" | .... | .... | China Mutual Steamship Co. |
| S.S. "Saint Jerome" | 2870 | .... | British Foreign Steamship Co. |
| S.S. "Windsor Park" | 2450 | .... | Park Steam Shipping Co. |
| S.S. "Willem IV" | .... | .... | Royal West Indian Mail Co. |
| S.S. "Dionee" | 2200 | 250 | A. C. LeQuellec. |
| S.S. "Boris" | .... | 141 | Bulgarian Trading Steam Navigation Co. |
| S.S. "Bulgaris" | .... | 156 | Bulgarian Trading Steam Navigation Co. |
| S.S. "Canada" | .... | .... | Compagnie Générale Transatlantique. |
| S.S. "Sylvania" | .... | .... | Cunard Steamship Co. |
| S.S. "Lobo" | .... | .... | ..... |
| S.S. "Germanic" | .... | .... | Ismay, Imrie and Co. |
| S.S. "Beacon Light" | .... | .... | R. Stewart and Co. |
| S.S. "Czaritza" | .... | .... | Russian Steam Navigation and Trading Co. |
| S.S. "Arala" | 3250 | 266 | Carlisle and Co. |
| S.S. "Benrath" | 3600 | 248 | West Hoult. |
| S.S. "Ailsawald" | 2930 | 240 | Lunn and Macoy. |
| S.S. "Ceylon" | 4250 | 500 | Peninsular and Oriental Steam Navigation Co. |
| S.S. "Calvados" | .... | .... | London, Brighton and South Coast Railway Co. |
| S.S. "Tronville" | .... | .... | London, Brighton and South Coast Railway Co. |
| S.S. "Armston Grange" | .... | .... | Houlder Bros. |
| S.S. "Simla" | 5850 | 700 | Peninsular and Oriental Steam Navigation Co. |
| S.S. "Cerberus" | .... | .... | Ocean Steamship Co. |
| S.S. "Warrington" | .... | .... | ..... |
| S.S. "Sea Lock" | .... | .... | River Wear Commissioners. |
| S.S. "Phoebe" | .... | 240 | Turnbull Bros. |
| H.M.S. "Prince George" | .... | .... | British Government. |
| S.S. "Conselheiro Pantas" | 2484 | 60 | Lloyds Barsileirs, Brazil. |
| S.S. "Sandrail" | .... | .... | River Wear Commissioners. |
| S.S. "Leopoldville" | 3460 | 300 | Elder Dempster and Co. |
| S.S. "Santo Domingo" | 2911 | 464 | Compania Transatlantica. |
| S.S. "Dupuy de Lome" | .... | .... | Chargeurs Rennis. |
| S.S. "Kammare" | .... | .... | City of Cork Steam Packet Co. |
| S.S. "Marino" | .... | 250 | Harland and Wolff, Limited. |
| S.S. "Rosario" | .... | .... | ..... |
| S.S. "Mosser" | .... | .... | J. H. Bushby. |
| S.S. "Flying Buzzard" | ... | .... | Clyde Shipping Co. |
| H.M.S. "Caesar" | .... | .... | British Government. |
| H.M.S. "Hannibal" | .... | .... | British Government. |
| S.S. "Mogue" | .... | .... | Mogue Steamship Co. |
| S.S. "Alfridi" | .... | .... | Mogue Steamship Co. |
| S.S. "Saltram" | .... | .... | J. Bellamy and Co. |
| S.S. "Oceanic" | .... | ... | Ismay, Imrie and Co. |
| S.S. "Cazengo" | ... | .... | ..... |
| S.S. "Benalder" | 3000 | 285 | Wm. Thomson and Co. |
| S.S. "Duke of Buckingham" | .... | .... | J. B. Westraig and Co. |
| S.S. "Finnieston" | .... | .... | ..... |
| S.S. "Malta" | 5850 | 700 | Peninsular and Oriental Steam Navigation Co. |
| S.S. "Amber" | .... | .... | ..... |
| S.S. "Ethelburga" | .... | .... | J. H. Harrowing. |
| S.S. "Federation" | .... | .... | ..... |
| Icebreaker | .... | .... | Malmo Harbor. |
| S.S. "Rotherdam" | ... | .... | L. Smit and Co. |

# Table Showing Working Pressure and Thickness of Morison Suspension Furnaces.

| Inside Diameter of Furnace. | WORKING PRESSURE IN POUNDS PER SQUARE INCH. THICKNESS OF FURNACE. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5/16 in. | 11/32 in. | 3/8 in. | 13/32 in. | 7/16 in. | 15/32 in. | 1/2 in. | 17/32 in. | 9/16 in. | 19/32 in. | 5/8 in. |
| 2 ft. 4 in. | 146 | 160 | 175 | 189 | 204 | 219 | 233 | 247 | 262 | 276 | 290 |
| 2 5 | 142 | 156 | 170 | 183 | 197 | 212 | 225 | 239 | 253 | 267 | 281 |
| 2 6 | 137 | 151 | 164 | 178 | 191 | 205 | 218 | 232 | 245 | 259 | 272 |
| 2 7 | 133 | 146 | 159 | 172 | 186 | 199 | 212 | 225 | 238 | 251 | 264 |
| 2 8 | 129 | 142 | 154 | 166 | 180 | 193 | 205 | 218 | 231 | 243 | 256 |
| 2 9 | 125 | 138 | 150 | 162 | 175 | 187 | 200 | 212 | 224 | 236 | 249 |
| 2 10 | 122 | 134 | 146 | 158 | 170 | 182 | 194 | 206 | 218 | 230 | 242 |
| 2 11 | 119 | 130 | 142 | 154 | 165 | 177 | 189 | 200 | 212 | 224 | 235 |
| 3 0 | 115 | 127 | 138 | 149 | 161 | 172 | 184 | 195 | 207 | 218 | 229 |
| 3 1 | 112 | 123 | 135 | 146 | 157 | 168 | 179 | 190 | 201 | 212 | 223 |
| 3 2 | 110 | 120 | 131 | 142 | 153 | 164 | 175 | 185 | 196 | 207 | 218 |
| 3 3 | 107 | 117 | 128 | 138 | 149 | 160 | 170 | 181 | 191 | 202 | 212 |
| 3 4 | 104 | 115 | 125 | 135 | 146 | 156 | 166 | 176 | 187 | 197 | 207 |
| 3 5 | 102 | 112 | 122 | 132 | 142 | 152 | 162 | 172 | 183 | 192 | 202 |
| 3 6 | 100 | 109 | 119 | 129 | 139 | 149 | 159 | 168 | 178 | 188 | 198 |
| 3 7 | 97 | 107 | 116 | 126 | 136 | 146 | 155 | 165 | 174 | 184 | 193 |
| 3 8 | 95 | 105 | 114 | 123 | 133 | 142 | 152 | 161 | 171 | 180 | 189 |
| 3 9 | 93 | 102 | 112 | 121 | 130 | 139 | 148 | 158 | 167 | 176 | 185 |
| 3 10 | 91 | 100 | 109 | 118 | 127 | 137 | 145 | 154 | 163 | 172 | 181 |
| 3 11 | 89 | 98 | 107 | 116 | 125 | 134 | 142 | 151 | 160 | 169 | 178 |
| 4 0 | 87 | 96 | 105 | 113 | 122 | 131 | 140 | 148 | 157 | 166 | 174 |
| 4 1 | 86 | 94 | 103 | 111 | 120 | 128 | 137 | 145 | 154 | 162 | 170 |
| 4 2 | 84 | 92 | 101 | 109 | 118 | 126 | 134 | 142 | 151 | 159 | 167 |
| 4 3 | 82 | 91 | 99 | 107 | 115 | 123 | 132 | 140 | 148 | 156 | 164 |
| 4 4 | 81 | 88 | 97 | 105 | 113 | 121 | 129 | 137 | 145 | 153 | 161 |
| 4 5 | 79 | 87 | 95 | 103 | 111 | 119 | 127 | 135 | 143 | 150 | 158 |
| 4 6 | 78 | 86 | 93 | 101 | 109 | 117 | 125 | 132 | 140 | 148 | 155 |
| 4 7 | 77 | 84 | 92 | 99 | 107 | 115 | 122 | 130 | 138 | 145 | 153 |
| 4 8 | 75 | 83 | 90 | 98 | 105 | 113 | 120 | 128 | 135 | 143 | 150 |
| 4 9 | 74 | 81 | 89 | 96 | 103 | 111 | 118 | 125 | 133 | 140 | 147 |
| 4 10 | 73 | 80 | 87 | 94 | 102 | 109 | 116 | 123 | 131 | 138 | 145 |
| 4 11 | 71 | 78 | 86 | 93 | 100 | 107 | 114 | 121 | 129 | 136 | 143 |

## Rule for Calculating the Pressure Allowable on Furnaces either Fox Corrugated or Morison Suspension

as adopted by the Board of U. S. Supervising Inspectors of Steam Vessels, Feb. 19th, 1894, corrugations to be 8 inches pitch and 1½ inches deep; the plain parts at ends not to exceed 6 inches in length.

$$\frac{14000}{D} \times T = \text{Working pressure, in pounds per sq. inch.}$$

14000 = a Constant.
T = thickness, in inches.
D = mean diameter, in inches = inside diameter + thickness of metal + 1½ inches.

EXAMPLE:—Given a Furnace 40 inches mean diameter, ½ inch thick, required the pressure allowed:—

40 ) 14000
———
350
·5
———
175.0 lbs. working pressure.

EXAMPLE:—Given a furnace 40 inches mean diameter, to carry 175 lbs. working pressure, required the thickness of metal:—

$\frac{P. \times D.}{14000}$ = thickness. $\frac{175 \times 40}{14000}$ = ½ inch, thickness of metal.

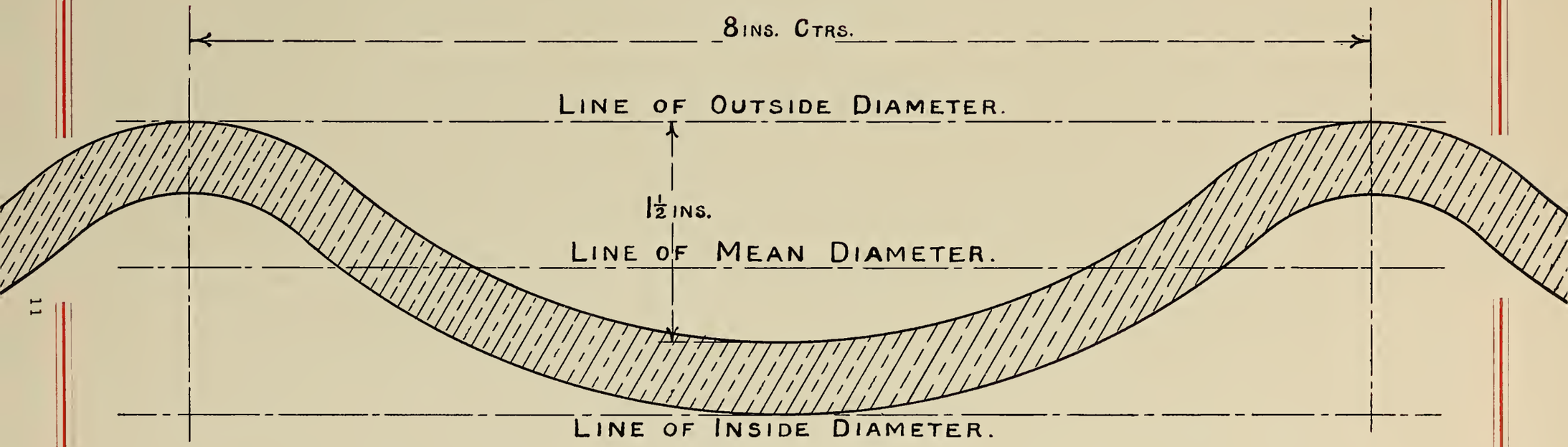
NOTE.—The plain parts at the ends of Furnaces referred to above, are measured as indicated on the following sketch.

**A**—Centre line of rivets.
**B**—Tangent point of curve.

# FULL SIZE DETAIL

OF

# CORRUGATION.




11

# Morison Suspension Furnace

(FOX-MORISON PATENTS).

MADE BY

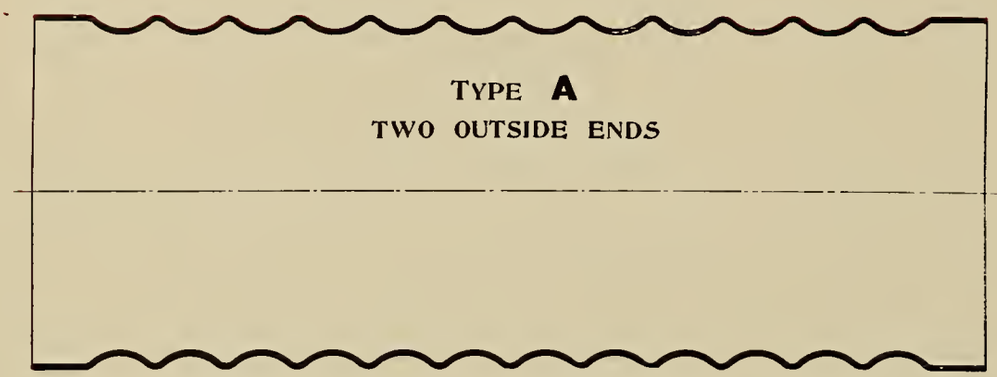
## The Continental Iron Works,

BROOKLYN, N. Y.

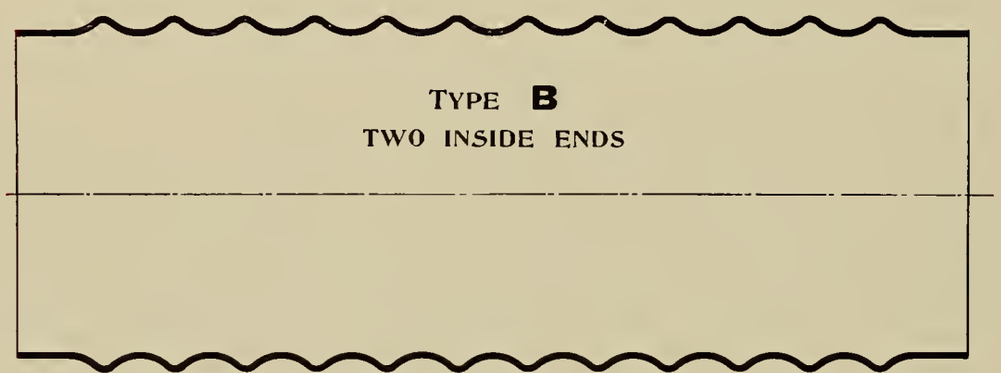
# TYPES OF MORISON SUSPENSION FURNACE

WITH

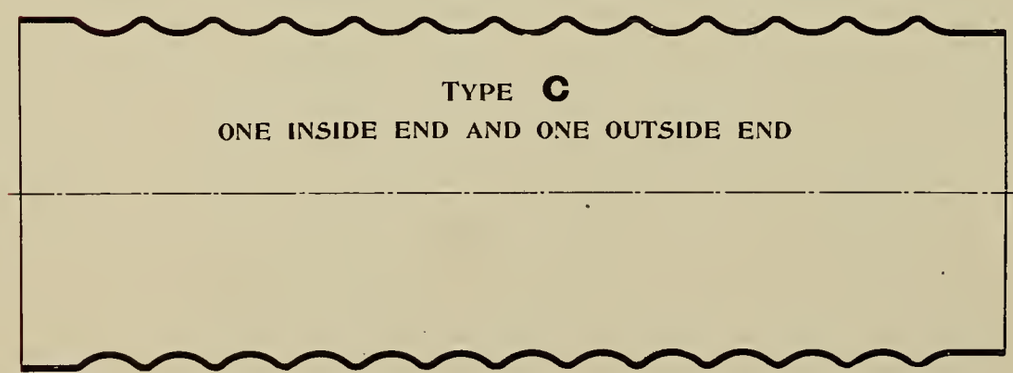
# Plain Ends



TYPE **A**
TWO OUTSIDE ENDS



TYPE **B**
TWO INSIDE ENDS



TYPE **C**
ONE INSIDE END AND ONE OUTSIDE END

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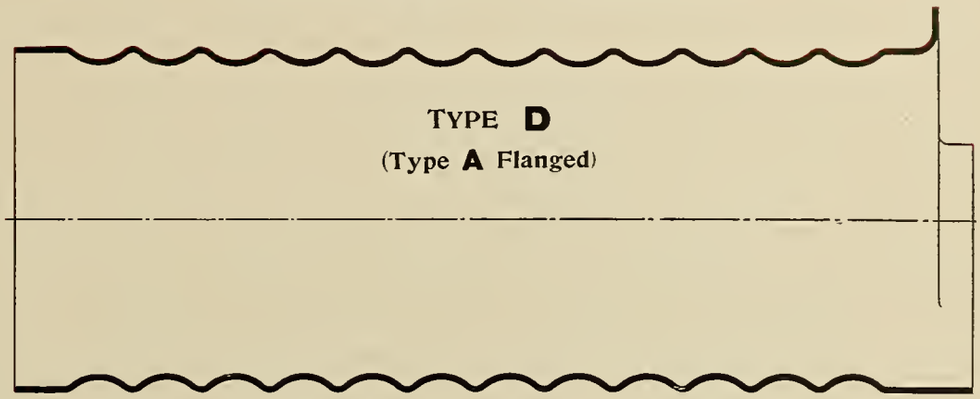
## THE CONTINENTAL IRON WORKS,

BROOKLYN, N. Y.

# TYPES OF MORISON SUSPENSION FURNACE

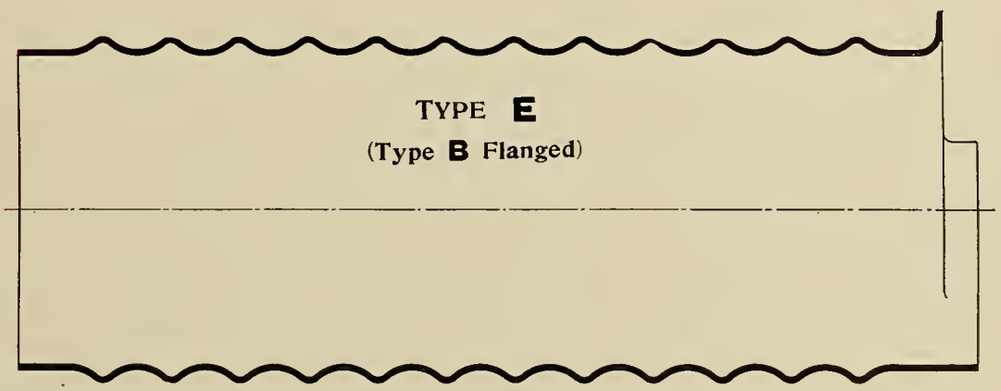
WITH

# Flanged Ends



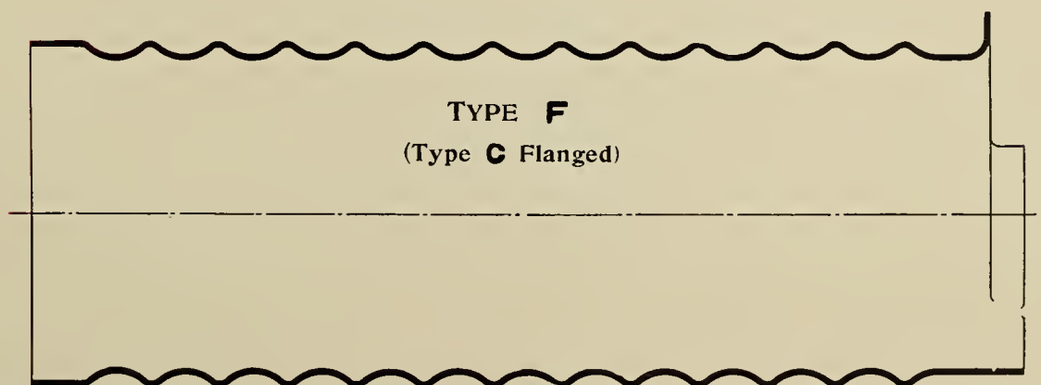
TYPE **D**

(Type **A** Flanged)



TYPE **E**

(Type **B** Flanged)



TYPE **F**

(Type **C** Flanged)

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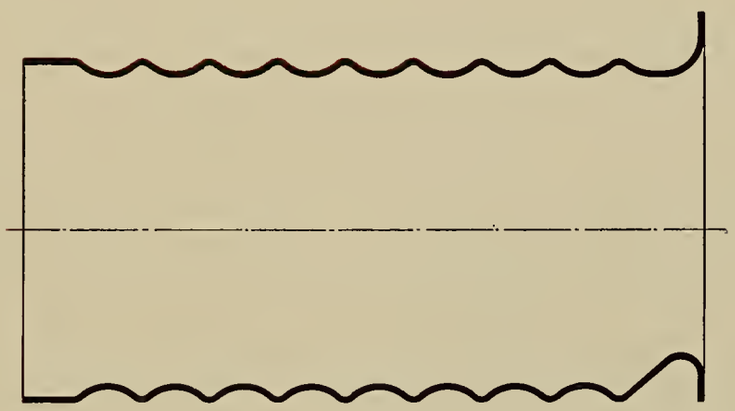
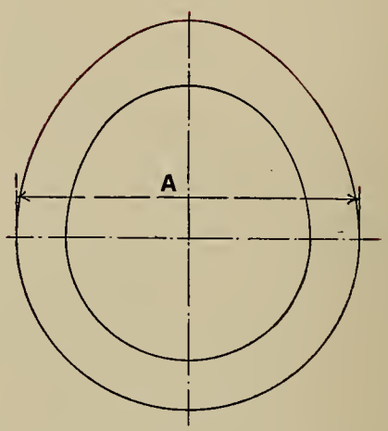
# MORISON SUSPENSION FURNACES.

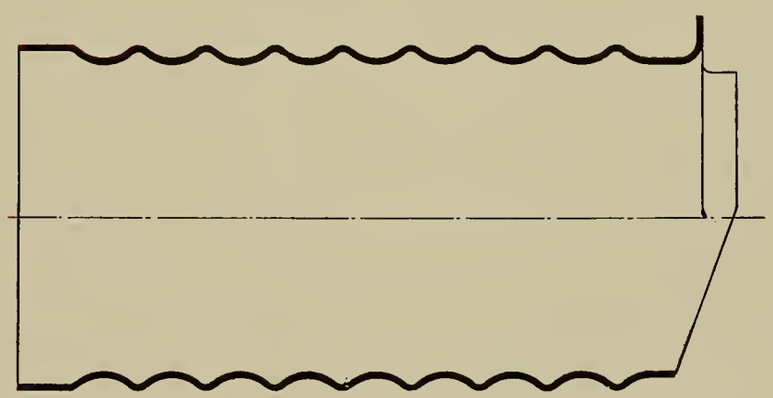
## INTERCHANGEABLE TYPES.



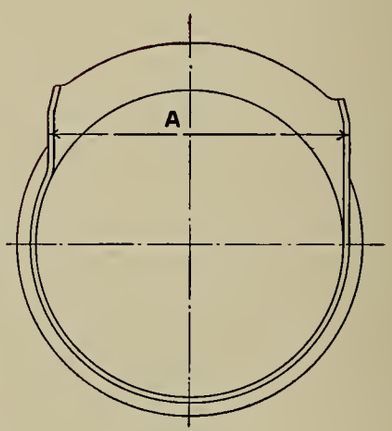
Dimension A
Should be 1-2
Inch less than
Diameter of
Furnace hole in
Boiler head.




## INTERCHANGEABLE TYPE **A.**



Dimension A
Should be 1-2
Inch less than
Diameter of
Furnace hole
In boiler head.




## INTERCHANGEABLE TYPE **B.**

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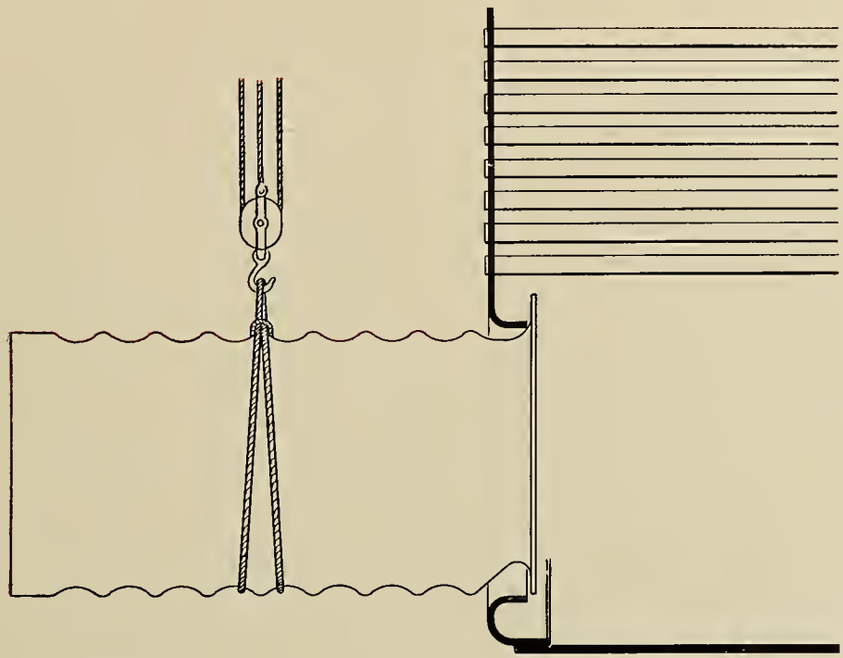
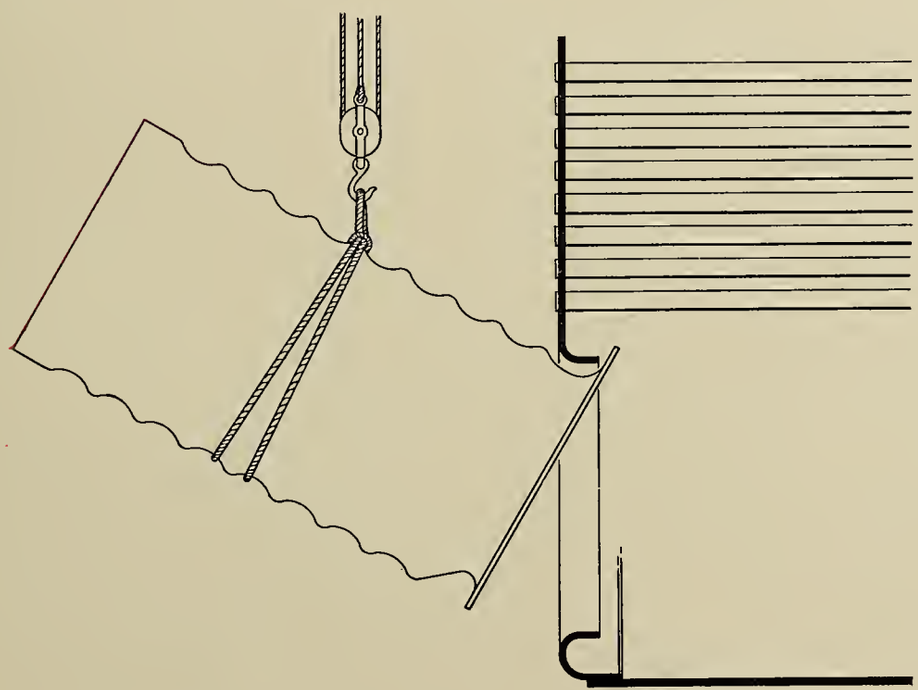
# MORISON SUSPENSION FURNACES.

APPLICATION OF

## INTERCHANGEABLE TYPES.



Showing Flanged Furnace
Drawn Forward
as far as Flange will allow.



Showing Removal of
Interchangeable Furnace Through
Furnace Hole in Head of
Boiler.

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BROOKLYN, N. Y.

# MORISON SUSPENSION FURNACES.

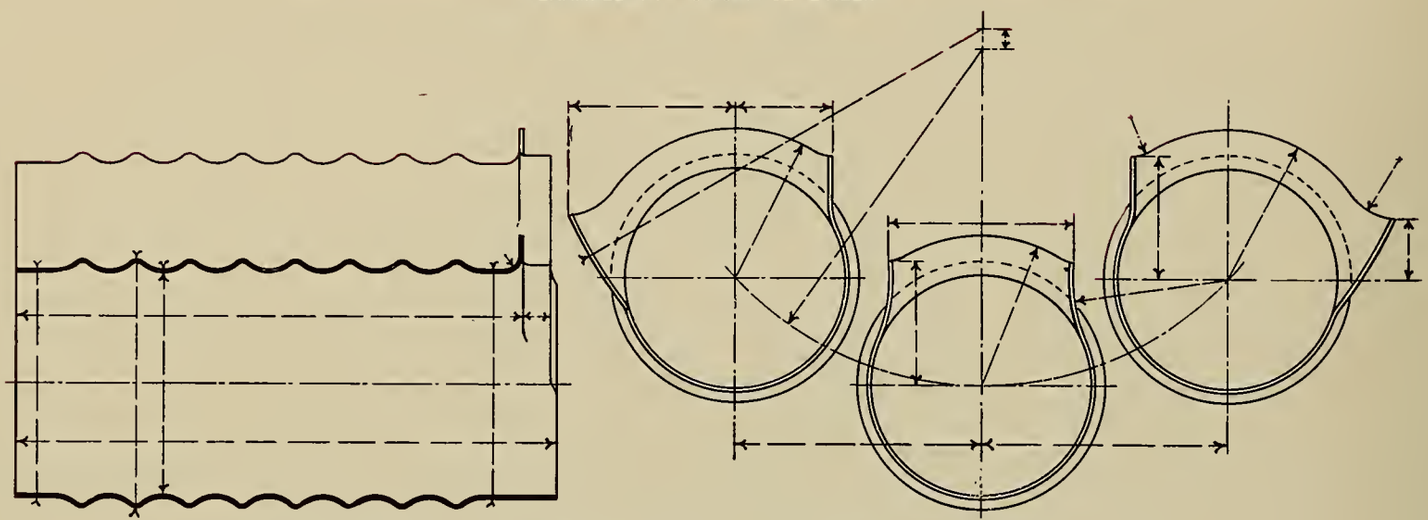
**SIZES MADE AND DATA NECESSARY FOR ESTIMATING AND FOR MANUFACTURING PURPOSES.**

ESTIMATES furnished on application for any size MORISON SUSPENSION FURNACE from 28 inches to 58 inches inside diameter. Any thickness from 5/16 to 5/8 of an inch, and any length up to 32 feet.

Inquiries for quotations must give type of furnace, inside diameter, thickness, and length, and if furnaces are to be flanged, a drawing showing type of flanging must be furnished. Quotations made by telegraph when required, on receipt of dimensions and particulars.

**SHOWING NECESSARY DATA FOR ESTIMATING ON FURNACES.**

EXAMPLE FOR 3-FURNACE BOILER.



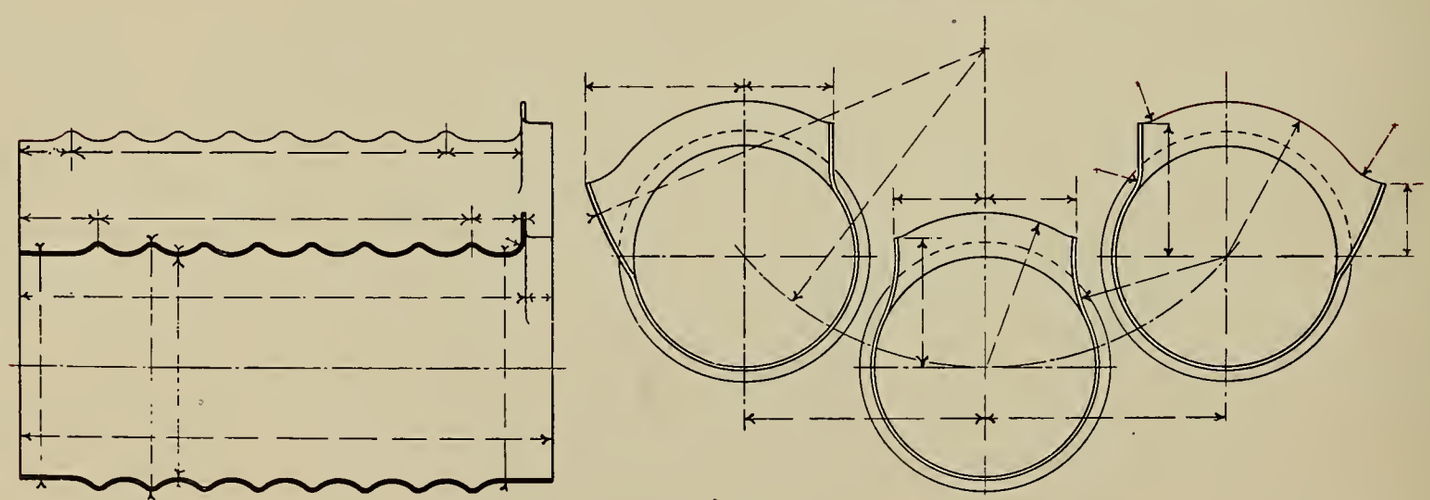
MORISON SUSPENSION BOILER FURNACES.

WORKING PRESSURE,.....LB. PER SQ. INCH.

---

## MORISON SUSPENSION FURNACES,

**with Corrugations arranged to ALTERNATE, giving practically UNIFORM WATER SPACE between furnaces.**

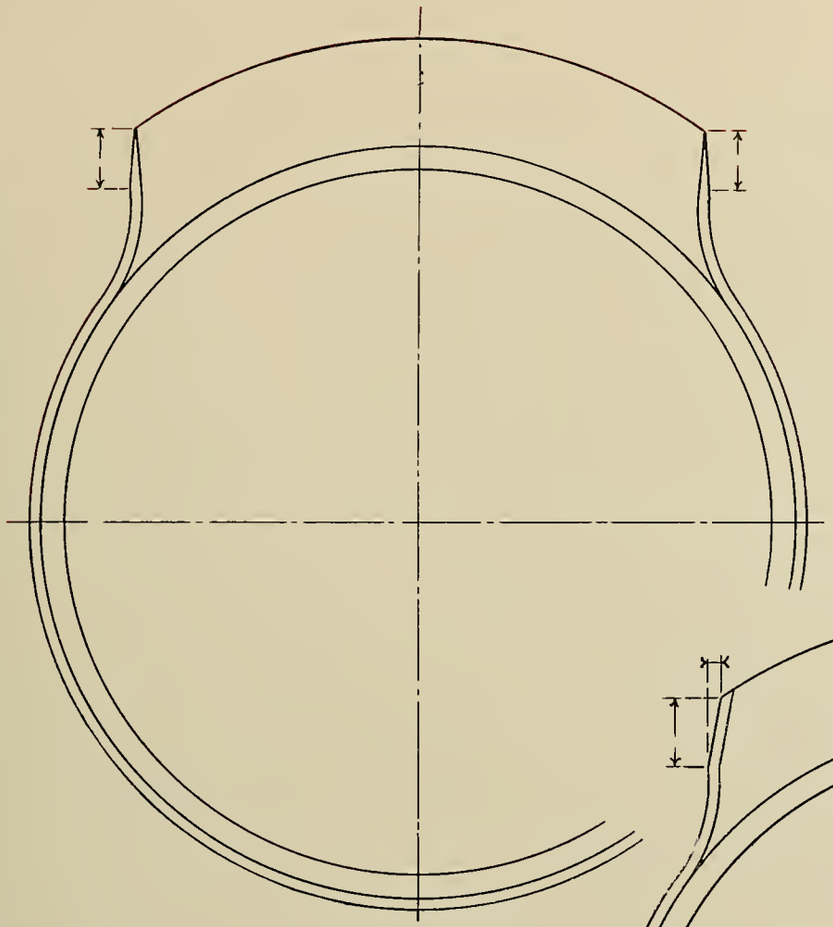


MADE BY

# THE CONTINENTAL IRON WORKS,

**BROOKLYN, N. Y.**

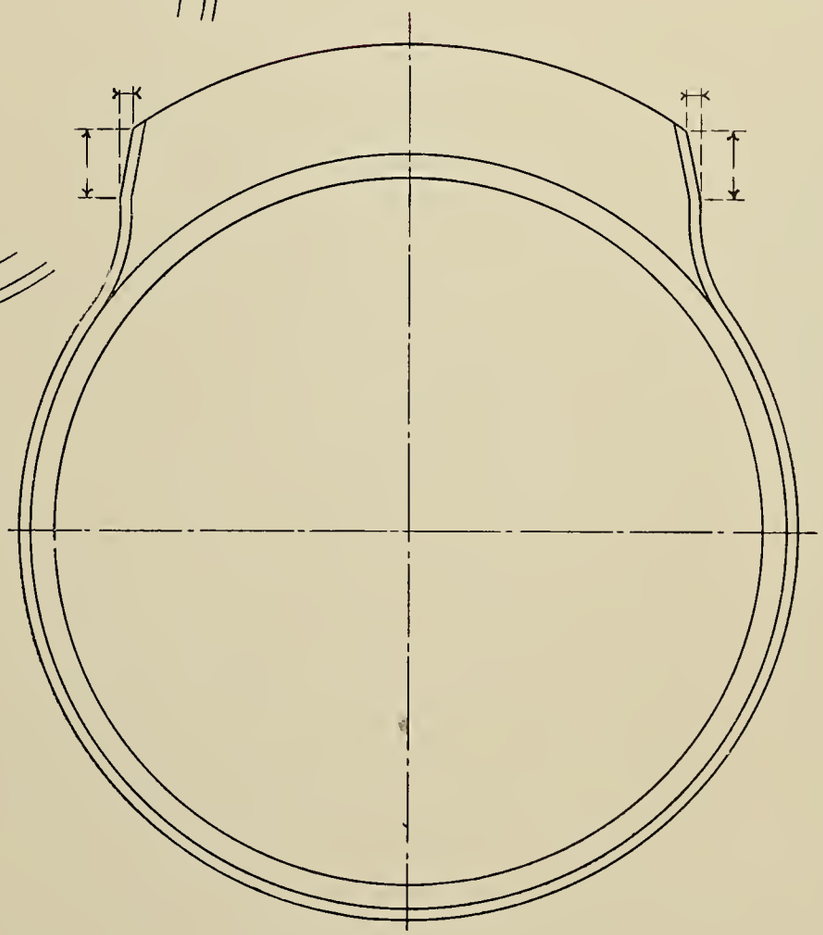
# MORISON SUSPENSION FURNACES.



## DRAWINGS OF FURNACES

Flanged at the Combustion Chamber end should always show the flanges "**THINNED**" or "**SET IN**" to fit the Tube Plates.

(**See Sketches.**)



**NOTE.**—It is important that the thinning and setting in above-mentioned should be done before the furnaces are annealed, this being the last operation of manufacture.

It is also suggested that the radius at the root of the Flanges should not be less than 1 inch inside, so as to avoid any unnecessarily sharp corners.

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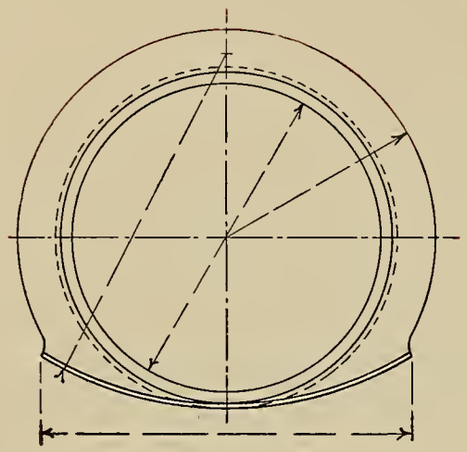
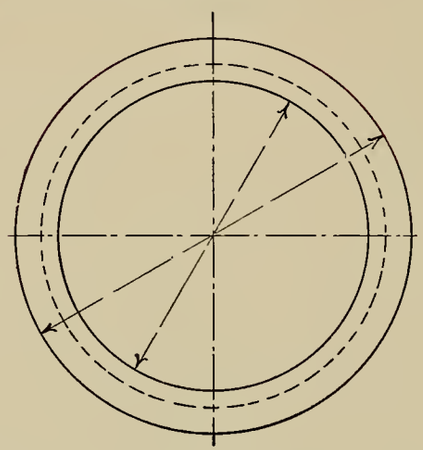
# MORISON SUSPENSION FURNACES.

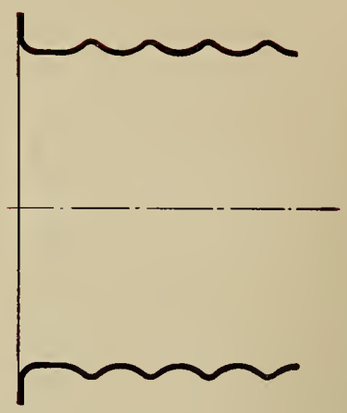
## TYPES OF FLANGING.



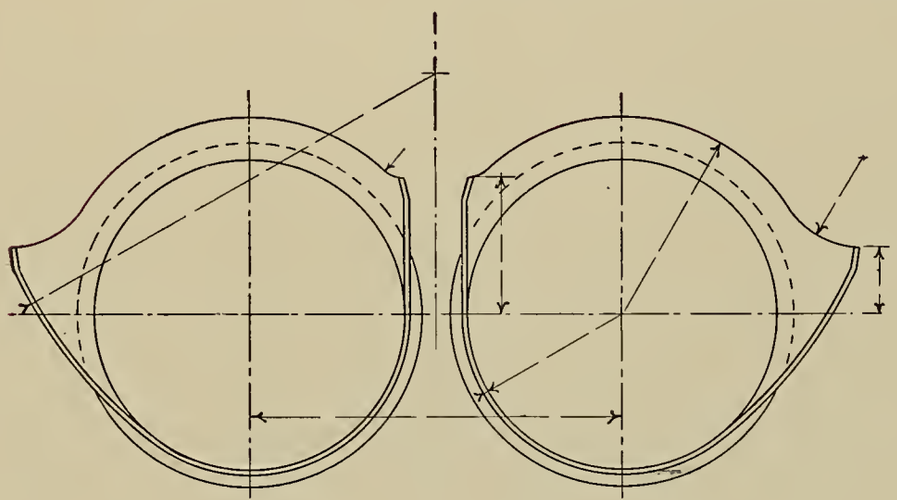
Type 1.



FOR SINGLE FURNACE BOILER.



Type 2.

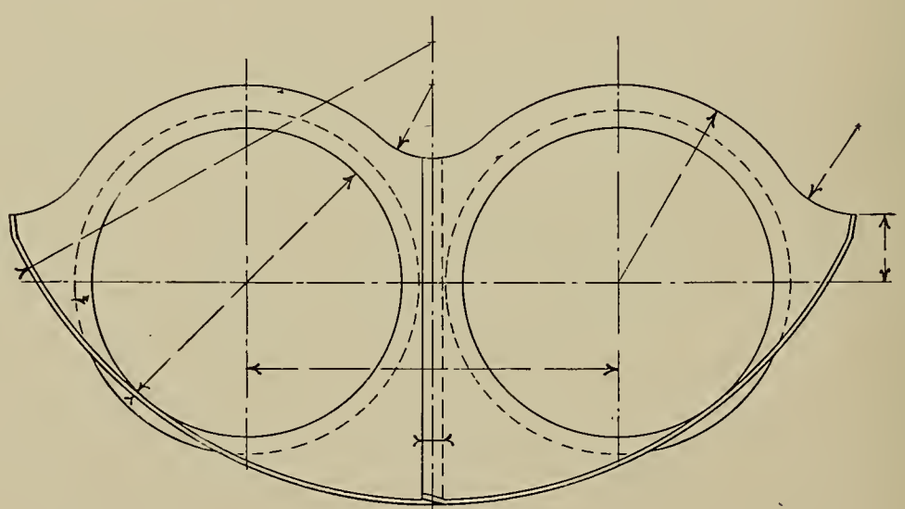


Type 3.

For TWO FURNACE BOILER with SEPARATE COMBUSTION CHAMBERS.

Type 4.

For TWO FURNACE BOILER with COMMON COMBUSTION CHAMBER.



MADE BY

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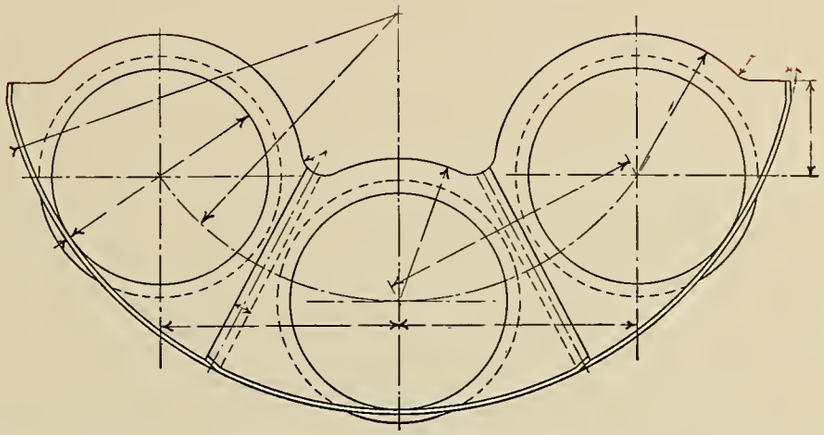
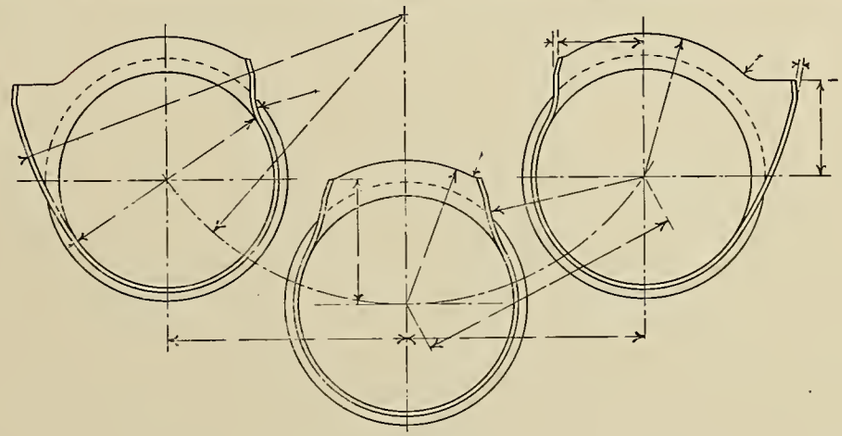
# MORISON SUSPENSION FURNACES.

## TYPES OF FLANGING.



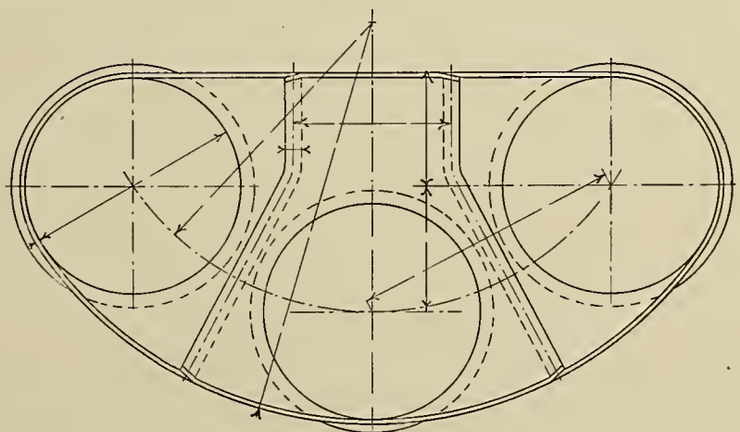
Type 5.

FOR THREE FURNACE BOILER, WITH COMMON COMBUSTION CHAMBER.



Type 6.

FOR THREE FURNACE BOILER, SEPARATE COMBUSTION CHAMBERS.



Type 7.

FOR THREE FURNACE BOILER, WITH COMMON COMBUSTION CHAMBER,

The Tubes Extending from Back End of Combustion Chamber.

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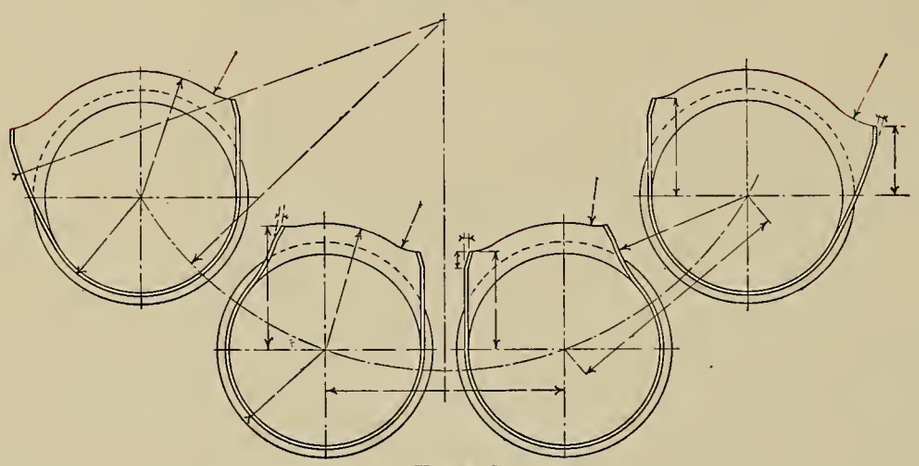
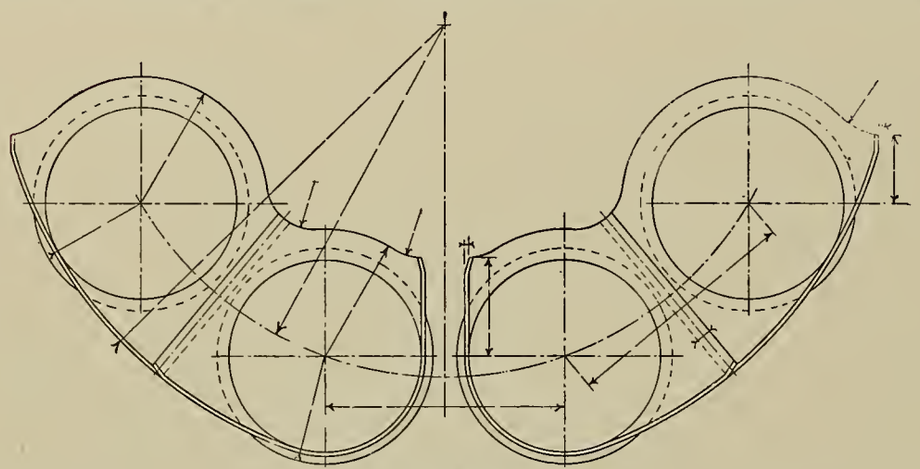
# MORISON SUSPENSION FURNACES.

## TYPES OF FLANGING.



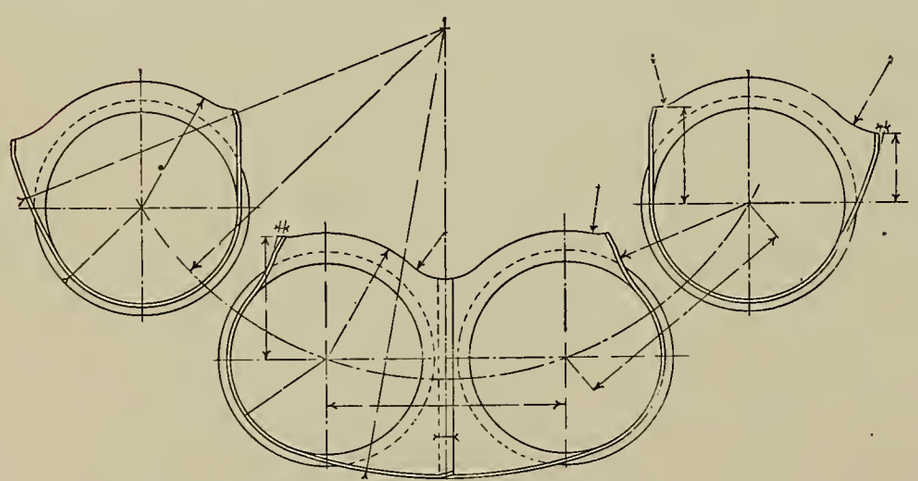
Type 8.

FOR FOUR FURNACE BOILER, WITH SEPARATE COMBUSTION CHAMBERS.



Type 9.

FOR FOUR FURNACE BOILER, WITH TWO COMBUSTION CHAMBERS.



Type 10.

FOR FOUR FURNACE BOILER, WITH THREE COMBUSTION CHAMBERS.

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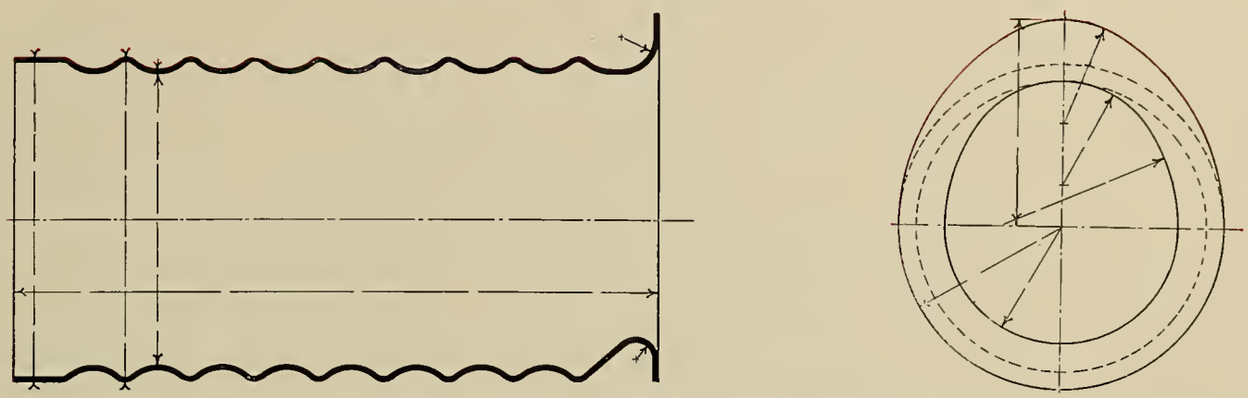
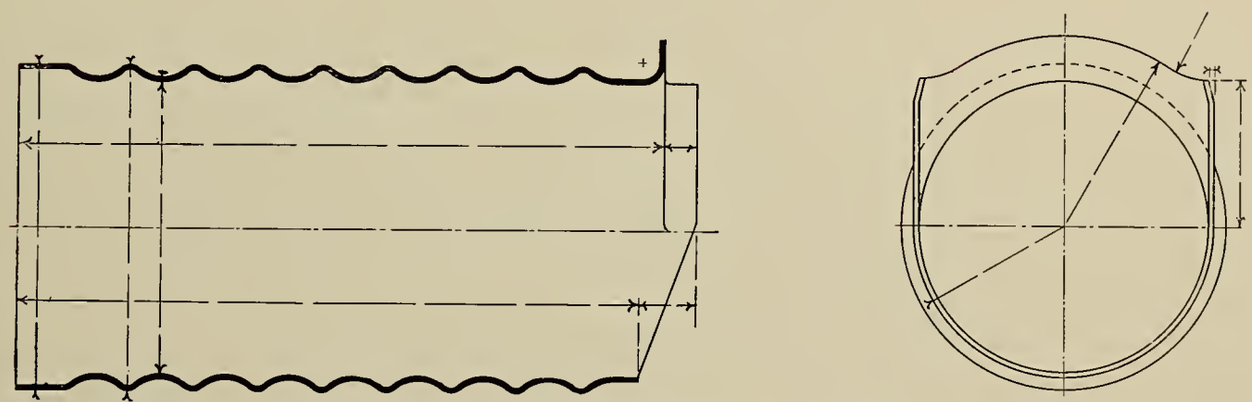
BROOKLYN, N. Y.

# MORISON SUSPENSION FURNACES.

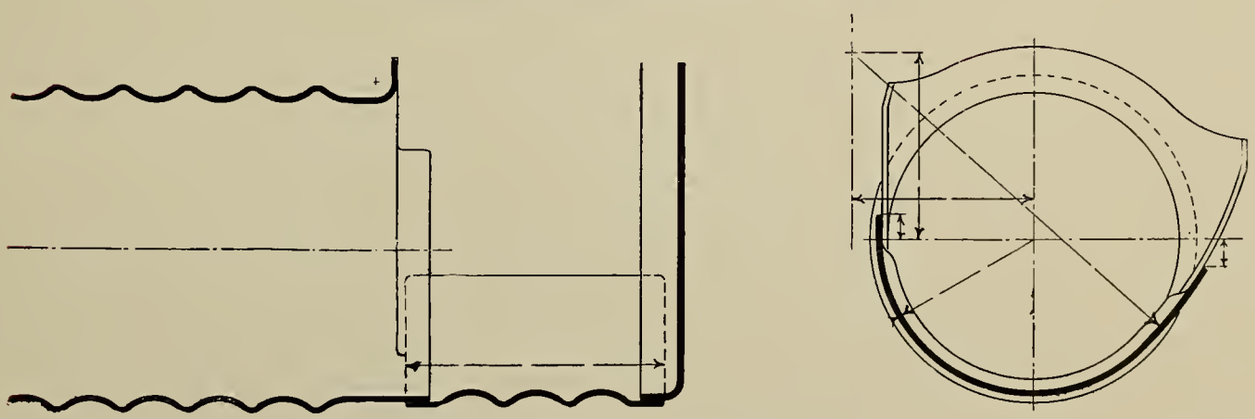
## Types of Flanging.



INTERCHANGEABLE TYPE **A.**



INTERCHANGEABLE TYPE **B.**



PATENT COMBUSTION CHAMBER BOTTOM.

MADE BY

## THE CONTINENTAL IRON WORKS,

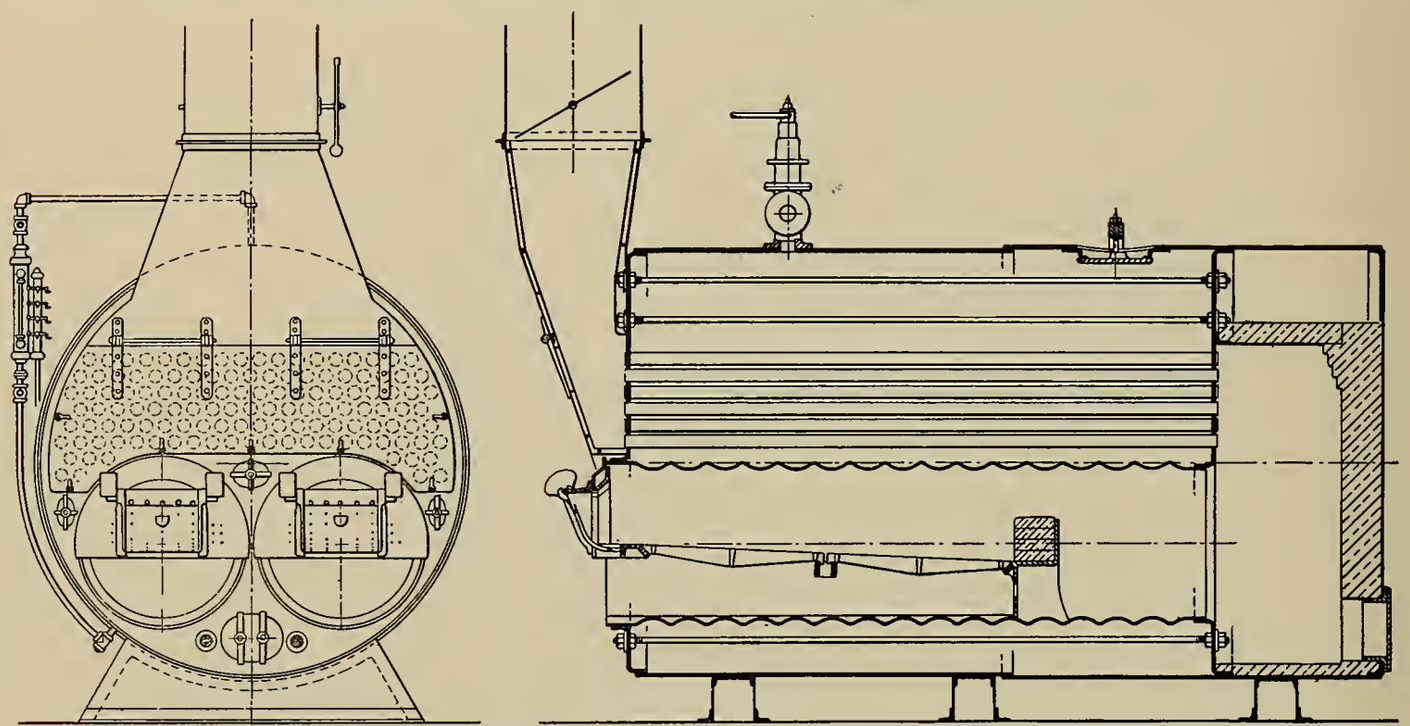
BROOKLYN, N. Y.

# LAND BOILERS Fitted with MORISON SUSPENSION FURNACES.

WITH the rapidly-increasing numbers of Stationary Engines of high efficiency, a demand has been created for boilers in which the necessarily high pressure of steam can be generated with the most economical consumption of fuel. This demand has been met by the introduction of internally-fired boilers, somewhat similar in design to the Scotch Boiler now so extensively employed in marine practice. This type of boiler is susceptible of numerous modifications in design, and when fitted with suspension furnaces becomes the most satisfactory steam generator that can be employed for stationary and semi-portable purposes.

**INTERNALLY-FIRED BOILERS** are economical in first cost, being self-contained; that is, they are independent of masonry setting, cast iron fronts, buckstays, tie rods, etc., and are therefore capable of being readily moved from place to place with little expense if desired.

**INTERNALLY-FIRED BOILERS** are economical in the consumption of coal, from the fact that there is no brick setting to absorb and radiate the heat, and the furnaces being surrounded by water the heat of combustion is more fully utilized than is possible in externally-fired boilers.



## SPECIAL ADVANTAGES ARISING FROM THE USE OF SUSPENSION FURNACES.

**CIRCUMFERENTIALLY-CORRUGATED FURNACES** possess much greater resistance to collapse than any other type, thus permitting the use of thinner metal in the furnace, which facilitates the transfer of heat to the water.

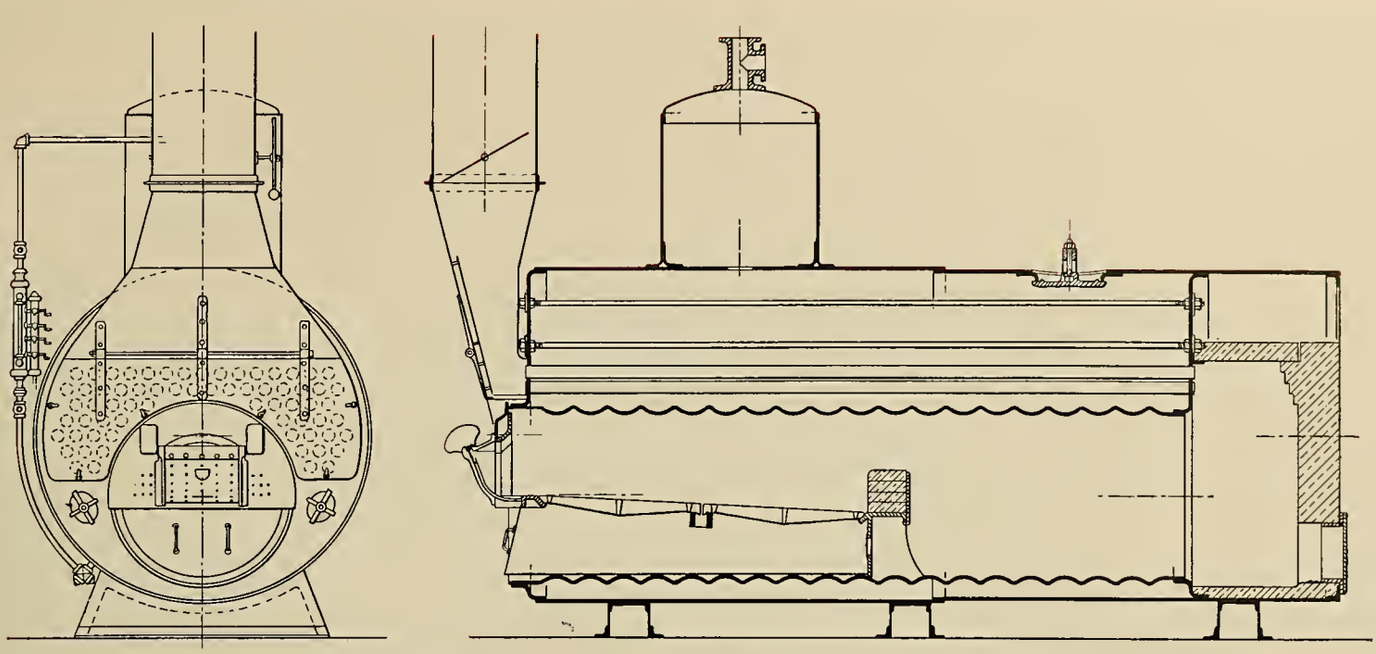
**THE CORRUGATIONS IN THE FURNACE** act as baffle-plates to the passage of the furnace gases, causing them to mechanically mix, thus producing far better combustion than is possible with any other type of furnace; while the additional heating surface in the most active portion of the boiler, due to the corrugations, adds largely to the evaporative power of the boiler.

**IN THE SUSPENSION FURNACE** the uniformity of thickness of metal is an especially desirable feature, facilitating the uniform transfer of heat, and permitting the free expansion and contraction of the furnace—features which it is impossible to obtain by means of thick ribs incorporated in the furnace plate, stiffening rings or any other device.

**THE SUSPENSION FURNACE,** while possessing wonderful resistance to collapse, possesses sufficient elasticity in the direction of its length to readily accommodate itself to alterations in dimension, caused by changes of temperature in the boiler, thus removing all excessive strains from the joints between it and the boiler heads—advantages impossible to be obtained with any other furnace.

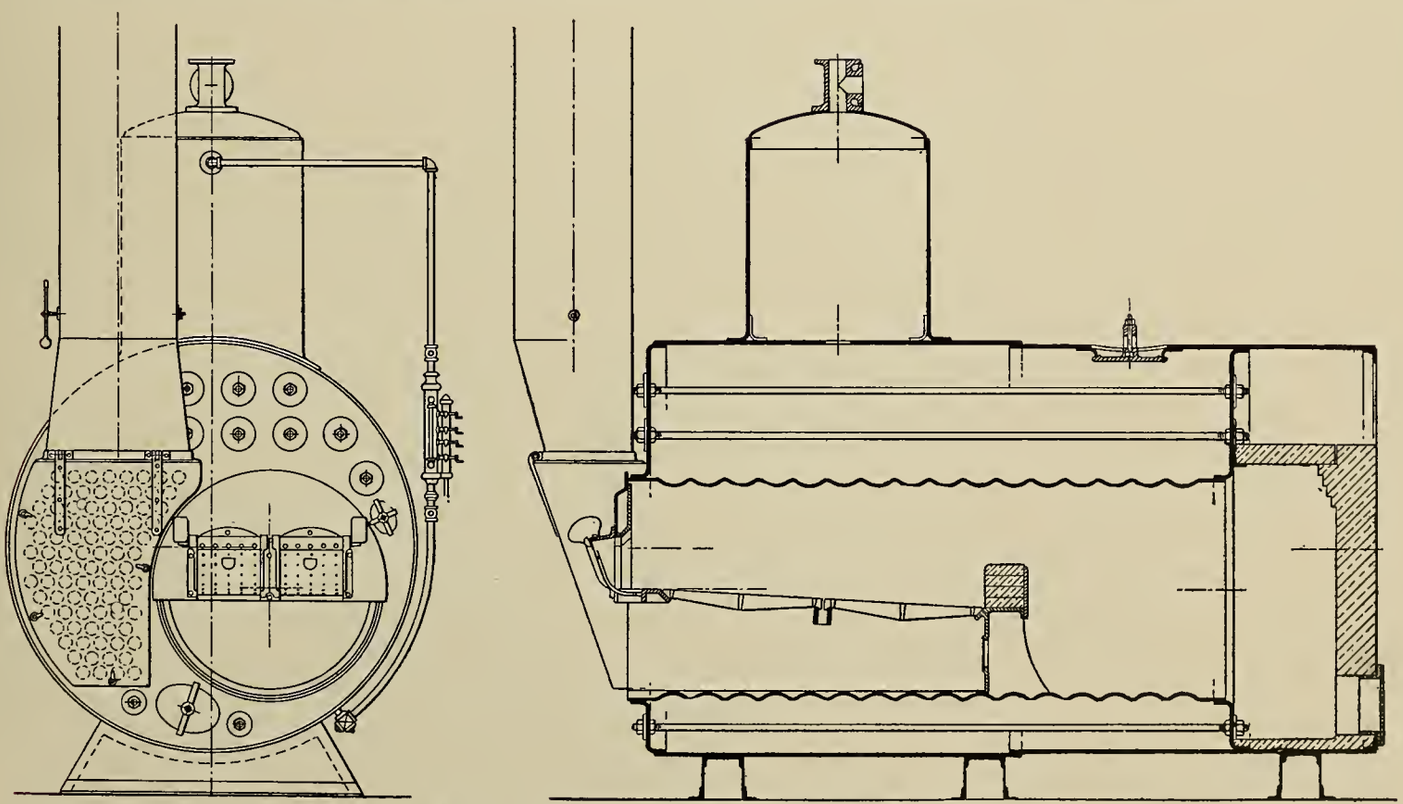
**SUSPENSION FURNACES** are necessarily made from the very best material, which, together with the first-class workmanship necessary for their production, insures the utmost perfection in the completed furnace.

# LAND BOILERS FITTED WITH Morison Suspension Furnaces.



**AMONG THE MANY USERS OF BOILERS OF THIS CHARACTER WE MAY MENTION:—**

CONSOLIDATED GAS CO., New York City.
BROOKLYN WATER WORKS, Brooklyn, N. Y.
PHILADELPHIA WATER WORKS, Philadelphia, Pa.
MINNEAPOLIS WATER WORKS, Minneapolis, Minn.
UNION GAS LIGHT CO., Brooklyn, N. Y.
METROPOLITAN GAS LIGHT CO., Elizabeth, N. J.
FRASERS & CHALMERS, for Masonic Temple, Chicago, Ill.
U. S. ARMY DEP'T, Fortifications at Sandy Hook, N. J.
DULUTH ELECTRIC LIGHT & POWER CO., Duluth, Minn.
ALDINE HOTEL, Philadelphia, Pa.
CARNEGIE LIBRARY, Pittsburgh, Pa.
NEWPORT NEWS WATER WORKS CO., Newport News, Va.
NORTH HUDSON CO. RAILWAY, Weehawken, N. J.
METROPOLITAN ELEVATED R. R., New York.
BERGNER & ENGEL BREWING CO., Philadelphia, Pa.
And very many others.

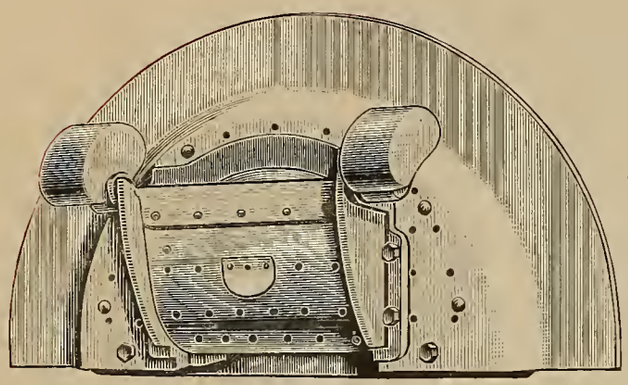


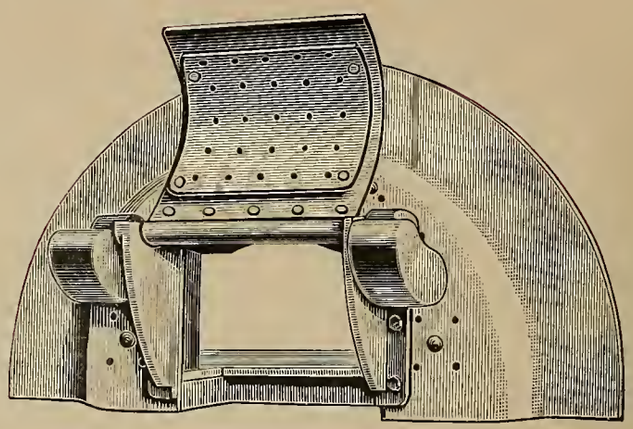
SIDE FURNACE, STATIONARY BOILER.

**MORISON SUSPENSION FURNACES, Made by THE CONTINENTAL IRON WORKS, Brooklyn, N. Y.**

# Morison Patent Furnace Door and Frame

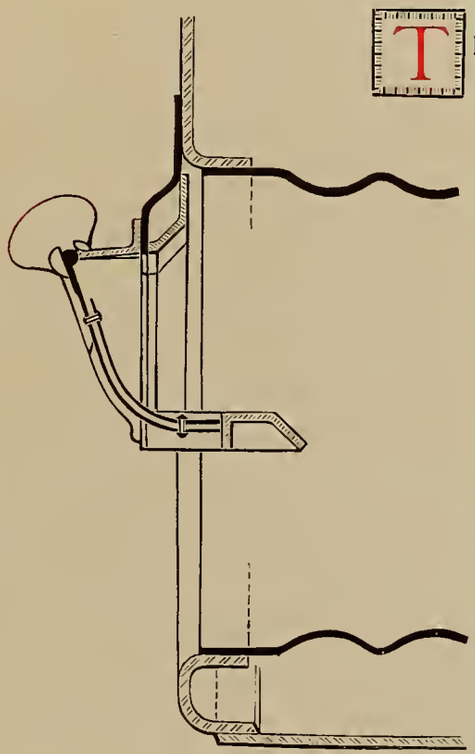
## FOR MARINE AND LAND BOILERS.





## Unequalled for Economical Firing.

## Prevents the Destruction of Baffle Plates.



THE FURNACE DOOR illustrated on this page is the invention of Mr. Donald B. Morison of Hartlepool, England, and is intended to overcome some of the defects which are inherent in the present type of furnace doors in use on marine and other boilers. The primary object is to prevent the undue accumulation of fuel on the front end of the grate which causes overheating and ultimate destruction of the furnace door and its attachments, and in consequence of the freedom from obstruction in the front end of the furnace, very much better facilities are afforded for properly stoking the fire. To accomplish this, a portion of the dead plate immediately inside of the furnace door, is cut away, so as to leave a recess. The door is provided with an inward extension, which when the door is closed, fills the recess in the dead plate. This extension and also the vertical portion of the door, may be perforated and be provided with a perforated baffle plate, for the admission of air to the furnace, in the usual way.

**THE FURNACE FRONT** is made of a plate of pressed steel, worked to the shape indicated in the illustrations and is protected from the fire by perforated cast iron liners.

**THE FURNACE DOOR** is arranged to open upward and is so counterweighted as to remain open while the furnace is being stoked. This is a very important feature in a marine boiler, as it does away with the necessity of catches or other devices for preventing the door from closing with the motion of the ship.

**ANOTHER IMPORTANT FEATURE** of the Morison Patent Furnace Door is that in consequence of the fire being removed from the immediate front of the furnace, the fire room is much cooler, which allows the men to work with more comfort than when the ordinary form of door is used.

**THESE DOORS and FRAMES** are made of several sizes to suit different size furnaces.

**FOR PRICES and OTHER INFORMATION, address,**

## THE CONTINENTAL IRON WORKS,

**P. O. Station "G," BROOKLYN, N. Y.**

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